

REMARKS

This is filed in response to the Office Action mailed October 3, 2007, rejecting claims 1 – 36 as allegedly unpatentable under 35 USC 101 and as allegedly anticipated by Hollier (US 5,794,188) under 35 USC 102. The Applicant requests reconsideration and withdrawal of the rejections in view of the comments below.

The Claims are Amended for Form

The claims are amended to correct typographic and grammatical errors. No new subject matter is added.

The Claims Recite Patentable Subject Matter

The Examiner rejects claims 1 – 36 as allegedly directed to non-statutory subject matter. The Applicant respectfully disagrees and asks that the Examiner reconsider and withdraw the rejection.

As noted in the Manual of Patent Examining procedure, to be considered a practical application of an abstract idea and therefore patentable subject matter, a claimed invention must either effect a physical transformation or achieve a useful, tangible, and concrete result. *See*, MPEP § 2106(IV)(C)(2). Each of the independent claims meets this standard.

Thus, for example, amended claims 1 and 35 recite *inter alia* a step of

adjusting the gain of the intelligibility enhancing device in accord with the candidate frequency-wise gain

Claim 16 similarly recites, *inter alia*, a step of

adjusting the gain of the hearing compensation intelligibility enhancing device in accord with the candidate frequency-wise gain characteristic chosen in step (H).

Claim 17 likewise recites, *inter alia*,

applying to the intelligibility enhancing device a frequency-wise gain (hereinafter, "applied frequency-wise gain") made by a process that maximizes an intelligibility metric of the communications path, where the intelligibility metric is a function of the relation:

$$AI = V_x E_x F_x H$$

Claims 30 and 36 are, furthermore, directed to an improved device for enhancing intelligibility of speech or sound by applying such an applied frequency-wise gain to an audio signal.

As is evident above, all of the independent claims (and, therefore, all of the claims) call for effecting a physical transformation of a signal and/or the gain of an intelligibility enhancing device (e.g., a hearing aid). These transformations are, moreover, useful, tangible, and concrete insofar as they improve the intelligibility of speech in an audio signal and make it easier for listeners to understand what they are hearing. See MPEP § 2106(IV)(C)(2). In this light, the claims fall well within the strictures of §101 and the rejection thereon ought be withdrawn.

The Claims are Patentably Distinct from the Art

Claims 1 and 2 – 36 stand rejected under 35 U.S.C. § 102(b) over U.S. Patent 5,794,188 by Hollier. The Applicant respectfully requests that the Examiner reconsider and withdraw this rejection in view of the comments below.

Hollier purports to provide a system for analyzing distortion in a signal in telecommunications device and generating a measure its subjective impact on a human listener. The publication is said to disclose an “analysis means” arranged to receive a first distorted signal corresponding to a test signal altered to account for those factors affecting human perception of sound and a second distorted signal corresponding to the first distorted test signal additionally distorted by the telecommunications device. The analysis means is said to calculate and sum the total error activity and error entropy values over time for the telecommunications device, correlating the error values with a human “listening effort” opinion score (“MOS”) to determinethe subjective impact of distortion on an audio signal due to the device (col. 10, lines 1- col. 11, line 13).

More generally, Hollier provides a method to analyze the communication device, whereas Applicant’s claimed invention is directed to signal processing methods and apparatus for maximizing intelligibility. Unlike the claimed invention, Hollier provides no steps or apparatus for improving the performance of a hearing aid or other intelligibility enhancing device. Although there may be some

overlap in terminology between the present application and Hollier — e.g., terminology such as signal-to-noise, loudness, spectral balance, and so forth — the goals and underlying techniques vary dramatically.

This is evident in analyzing some of the quotes from Hollier on which the Examiner relied in his Office Action. For example, the Examiner asserts that “...Hollier teaches a method to enhance the intelligibility of speech in an audio signal in a communications path (col. 2 lines 22-28, lines 48-60). . . .” However, reviewing the cited passage, it is evident that Hollier aims only to determine a metric that is a subjective measure of human perception of the telecommunications device performance. Hollier does not propose to modify, enhance, or optimize processing of that device, an intelligibility enhancing device, or any other device along dimensions such as intelligibility or quality — or any other dimension, for that matter.

The Examiner further suggests that Hollier discloses “...having an adjustable gain in the frequency domain (as adjusted filter gains—col. 8 lines 1-15...)” The Applicant respectfully disagrees. The cited passage does not pertain to adjusting filter gains. It pertains to choosing the ear transfer function appropriate to the location of the sound source relative to ear (or head) position. Hollier uses this to calibrate the input waveform, nothing more.

The Examiner also suggests that Hollier is relevant for its mention of “...loudness (col. 14 lines 54-65). . . .” Although this citation may have resulted from a simple word-search on “loudness,” it is not otherwise germane. As Hollier makes clear elsewhere, the disclosure uses an ISO standard to translate objective measurements into the percept of loudness (“a nonlinear function of amplitude”).

In regard to the Examiner’s statement that “...Hollier teaches broadband gain adjustment as well as particular frequency gain adjustment (via masking—col. 8, lines 10-43). . . .,” the cited text describes how Hollier makes measurements using bandpass filters and converts this to loudness via an existing ISO loudness standard. There is no broadband gain adjustment or frequency specific gain adjustment here or anywhere else in Hollier.

The Applicant also respectfully disagrees with the Examiner’s assertion that “...Hollier teaches equivalent masking/gain adjustments via Bark frequency adjustments and perceptual masking (col. 6 line 20—col. 7 line 30). . . .” In the cited text, Hollier describes an approach to translate the waveform into perceptual terms. Hollier does not adjust any parameters to change or improve the performance of a communication device, an intelligibility enhancing device, or otherwise.

The Examiner states that "...Hollier teaches repeating the process to obtain an average the measures noise/clipping, and using energy values to determine the highest intelligibility (col. 11 lines 20-40)..." However, in the cited passage, Hollier states that weights are assigned to portions of the waveform that occur frequently in natural speech and to segments less susceptible to clipping (clipping in the temporal domain) because these segments have more influence on "listening effort." While Hollier says that the analysis was "...repeated for different levels of distortion..." there is no suggestion (as the Examiner asserts) that the process is repeated to obtain an average that measures noise/clipping. Nor is their suggestion of using energy values to determine the highest intelligibility.

Turning, now, to Applicant's claimed invention, **independent claim 1** recites a method of enhancing intelligibility of speech in an audio signal perceived by a subject via a communications path that includes an intelligibility enhancing device with an adjustable gain, comprising generating a candidate frequency-wise gain that, if applied to the device, would maximize an intelligibility metric of the communications path. The method further comprises adjusting the gain of the intelligibility enhancing device in accord with the candidate frequency-wise gain.

Hollier neither teaches nor suggests adjusting the gain of an intelligibility enhancing device. In rejecting claim 1, the Examiner cites to gain adjustments in column 8, lines 10-43. But, these passages are directed towards a method for calculating a signal's effect on a human ear (see col. 8, lines 10-43) and do not teach adjusting the gain of an intelligibility-enhancing device as required by claim 1. Thus, claim 1 is patentable over the cited art, as are claims 3-15, which depend either directly or indirectly from claim 1.

Independent claim 16 recites a method of enhancing intelligibility of speech in an audio signal perceived by a subject via a communications path including an intelligibility enhancing device with an adjustable gain. The method comprises making a series of candidate frequency-wise and broadband gain adjustments and intelligibility metric calculations to determine a candidate frequency-wise gain value that maximizes an intelligibility metric of speech in the audio signal. The method further comprises adjusting the gain of the device in accord with the candidate frequency-wise gain value so calculated.

Hollier neither teaches nor suggests a series of adjustments to broadband and candidate frequency-wise gains to determine a frequency-wise gain value that maximizes the intelligibility of speech in an audio signal, nor adjusting gain of an intelligibility enhancing device in the communication path of the signal according to the frequency-wise gain value. In rejecting claim 16, the Examiner remarks that claims 16 – 36 are similar in scope and content to claims 1 – 15, and so are rejected under similar rationale. In this latter regard, the Examiner asserts that Hollier teaches broadband and frequency-

wise gain adjustments, citing column 8, lines 10-43. But, the cited passage does not show that Hollier contemplates such adjustments. Rather, the passage relates to calculating the effect of a test signal on a human ear, by first splitting and filtering the signal, then converting the filtered signal to a loudness level more representative of what a human ear would perceive (see col. 8, lines 10-43). There is no adjustment of a gain of the telecommunications system, much less an adjustment according to a calculated candidate frequency-wise gain to enhance intelligibility of the signal as taught in the method of claim 16. Thus, claim 16 is patentable over Hollier.

Independent claim 17 recites a method of enhancing intelligibility of speech in an audio signal perceived by a subject via a communications path having an intelligibility enhancing device. The method includes calculating a frequency-wise gain by a process that maximizes an intelligibility metric of the communications path and further includes applying the calculated frequency-wise gain to the intelligibility-enhancing device.

Hollier neither teaches nor suggests applying a gain to an audio signal. Again, the Examiner cites purported gain adjustments in column 8, lines 10-43. But, these passages are directed towards a method for calculating a signal's effect on a human ear (see col. 8, lines 10-43) and do not teach applying a frequency-wise gain to an intelligibility-enhancing device as required by claim 17. Thus, claim 17 is patentable over the cited art, as are claims 18-29, which depend either directly or indirectly from claim 17.

Independent claim 30 discloses a device for enhancing intelligibility of speech in an audio signal perceived by a subject via a communications path that includes the device. The device applies a frequency-wise gain to the audio signal, where the frequency-wise gain is calculated to maximize an intelligibility metric of the communications path.

Hollier neither teaches nor suggests a device that applies a frequency-wise gain to an audio signal. Again, the Examiner cites to gain adjustments in column 8, lines 10-43. But, this passage is directed towards an apparatus for calculating a signal's effect on a human ear (see col. 8, lines 10-43) and does not teach a device that applies a frequency-wise gain to an intelligibility-enhancing device as required by claim 30. Thus, claim 30 is patentable over the cited art, as are claims 31-34, which depend from claim 30.

Independent claim 35 discloses a method of enhancing intelligibility of sound contained in an audio signal perceived by a subject via a communications path, where the communications path includes a intelligibility enhancing device having an adjustable gain, that comprises generating a candidate

frequency-wise gain that, if applied to the intelligibility enhancing device, would maximize an intelligibility metric of the communications path. The method further comprises adjusting the gain of the intelligibility enhancing device in accord with the candidate frequency-wise gain.

Hollier neither teaches nor suggests a method that comprises adjusting the gain of an intelligibility enhancing device. The Examiner's citation to column 8, lines 10-43 as evidence that Hollier teaches gain adjustment is misdirected as this passage is not directed to a method of enhancing intelligibility of a signal via gain adjustment as required by claim 35, but rather to a method of calculating the effect of a signal on a human ear (see col. 8, lines 10-43). Thus, claim 35 is patentable over the cited art.

Independent claim 36 discloses a device for enhancing intelligibility of sound in an audio signal perceived by a subject via a communications path that includes the device. The device applies a frequency-wise gain to the audio signal where the gain is derived via a process for maximizing an intelligibility metric of the path.

Hollier neither teaches nor suggests a device that applies a frequency-wise gain to an audio signal. Again, the Examiner's citation to gain adjustments in column 8, lines 10-43 is misdirected, as this passage is directed towards an apparatus for calculating a signal's effect on a human ear (see col. 8, lines 10-43) and does not teach a device that applies a frequency-wise gain to an intelligibility-enhancing device as required by claim 36. Thus, claim 36 is patentable over the cited art.

In view of the foregoing, it is evident that Hollier fails to teach or suggest the subject matter of Applicant's independent claims and, therefore, Applicant's dependent claims — which recite still further limitations on the independent claims. Withdrawal of the § 102 rejection is, accordingly, requested.

Conclusion

In view of the amendments and remarks above, all claims of the present patent application are in condition for allowance. Prompt notice to this effect is requested.

Respectfully submitted,

Dated: 1/3/08

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